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Networks, ownership and productivity does firm age play a moderating role?

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Abstract

Purpose – The purpose of this study is to investigate whether and how inter-firm cooperation and firm age moderate the relationship between family ownership and productivity.
Design/methodology/approach – We first estimate the total factor productivity (TFP) of a large sample of Italian firms observed over the period 2010–2018 and then apply a Poisson random effects model.
Findings – TFP is, on average, higher for non-family firms (non-FFs) than for FF. Furthermore, inter-organizational cooperation and firm age mitigate the negative effect of family ownership. In detail, it is found that belonging to a network acts as a moderator in different ways according to firm age. Indeed, young FFs underperform non-FF peers, although the TFP gap decreases with age. In contrast, the benefits of a formal network are high for older FFs, suggesting that an age-related learning process is at work.
Practical implications – The study provides evidence that FFs can outperform non-FFs when they move away from Socio-Emotional Wealth-centered reference points and exploit knowledge flows arising from high levels of social capital. In the case of mature FFs, networking is a driver of TFP, allowing them to acquire external resources. Since FFs often do not have sufficient in-house knowledge and resources, they must be aware of the value of business cooperation. While preserving the familiar identity of small companies, networks grant FFs the competitive and scale advantages of being large.
Originality/value – Despite the wide but ambiguous body of research on the performance gap between FFs and non-FFs, little is known about the role of FFs' heterogeneity. This study has proven successful in detecting age as a factor in heterogeneity, specifically to explain the network effect on the link between ownership and TFP. Based on a representative sample, the study provides a solid framework for FFs, policymakers and academic research on family-owned companies.

Keywords Family firms, Inter-firm networks, Productivity, Age, Generational stage, Manufacturing firms
Paper type Research paper

1. Introduction

The effect of family involvement on firm performance is a widely debated issue, given the importance of family businesses in many economies. Nevertheless, some questions remain open as the empirical evidence is still inconclusive and because the heterogeneity of family

JEL Classification — D24, G32, L14, C23

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firms (FFs) has not been sufficiently investigated (Daspit *et al.*, 2021; Hernández-Linares *et al.*, 2017). This study attempts to address the gap mentioned above by considering two heterogeneity factors, inter-firm cooperation and firm age, which jointly contribute to explaining the mixed findings from prior research.

Regarding the relationship between cooperation and performance, several papers have shown that productivity depends also on the relationships with other enterprises. Through cooperation, firms overcome their lack of expertise and resources (Meier, 2011), thus improving their performance (Nonaka, 1994).

However, in the context of FFs literature, external collaboration may positively or negatively influence performance. On the one hand, belonging to a network allows firms to innovate and compete in global markets where large companies dominate. Thus, the network aims to exploit the scale advantages of being part of a large aggregation. Similarly, it preserves familiar identity and business independence, flexibility and adaptability to the cycles, which are typical distinctive traits of FFs (Gómez-Mejia *et al.*, 2007). On the other hand, the benefits from external collaborations may be outweighed by the costs associated with managing the complexity of a large alliance (Gkypali *et al.*, 2017). These costs are higher at the beginning of the business activity because family members have little experience and must experiment to learn about and connect with their environment (Cucculelli *et al.*, 2014; De Massis *et al.*, 2014). Moreover, in the early stages of firm life, the strategic choices tend to reflect more the desire to accomplish family-centered interests rather than economic goals (Berrone *et al.*, 2012; Gómez-Mejia *et al.*, 2007), while the emotional attachment decreases in subsequent generations (Sciascia *et al.*, 2014). A result is that FFs' willingness to collaborate with other partners could differ over time, affecting how partnership influences performance.

From the above, firm age, a *proxy* of experience and generational stage, might moderate the relationship between business cooperation and FFs' productivity. Accordingly, we investigate whether the productivity gap between FFs and non-FFs can be attributed to the different abilities and willingness to collaborate and whether this is, in turn, influenced by firm age. In particular, the study examines whether firms gain from participating in a network, at what stage of their life can benefit most, and finally, whether there are differences between FFs and non-FFs.

To analyze the firm ownership–productivity *nexus*, we use a sample of Italian firms observed over the 2010–2018 period. Data are from two archives, one containing balance sheets (Bureau Van Dijk – Aida) and the other providing details of collaborations among firms (Italian Chamber of Commerce). Following Aiello *et al.* (2015), performance is gauged by TFP which we estimated through the Levinsohn and Petrin (2003) method. Collaboration among Italian firms is measured by the network instrument *Network Contract*, established in 2009.

While we show that FFs are less productive than non-FFs, the findings support the opportunity to include collaboration and firm age as sources of FFs' heterogeneity. This improves the understanding of the relationship between ownership and TFP. Networks act as moderator in different ways according to age: young FFs perform less well than their non-FF peers, although the TFP gap reduces with age; in contrast, middle-aged FFs outperform their non-FF counterparts, and their TFP gain increases with age.

These findings cast doubt regarding the generally negative influence of ownership. They extend the understanding of how specific attributes enable FFs to benefit from cooperating with others. This helps to limit indeterminacies on FFs' performance and enriches the debate on FFs' heterogeneity (Daspit *et al.*, 2021; Hernández-Linares *et al.*, 2017). In this regard, the work explains how and why FFs differ in performance by considering the role of cooperation and age. Moreover, the study contributes to the cooperation literature, demonstrating that the impact of cooperative activity on FF productivity is not determined by cooperation alone but that firm age matters.

The paper is structured as follows. Section 2 presents the theoretical framework and the development of the hypotheses. Section 3 describes the empirical setting, while results are presented in Section 4. Finally, Section 5 concludes.

2. Theoretical background and hypothesis approach

2.1 Family involvement and productivity

Although prior research remains inconclusive about the effect of family ownership, a growing interest in the literature is on FFs' performance. Some scholars have suggested that family involvement can have a positive effect (Anderson and Reeb, 2003; Barontini and Caprio, 2006; Eugster and Isakov, 2019; Koji *et al.*, 2020; Poutziouris *et al.*, 2015). Adverse effects have been discussed by Castillo and Wakefield (2006) and Cucculelli and Micucci (2008).

While this mixed evidence might be caused by the divergent measures of performance used by scholars, the inconclusiveness of the findings also emerges when narrowing the attention to specific firm outcomes.

This is the case of firm productivity. Although productivity is ultimately a fundamental driver of firm performance, it must be clarified that it has captured only modest interest from family business scholars. Cucculelli *et al.* (2014) and Damiani *et al.* (2018) show that Italian FFs perform worse than non-FFs. The same applies to the Norwegian (Barth *et al.*, 2005) and Finnish (Buchanan *et al.*, 2022) FFs. Palia and Lichtenberg (1999) find a positive impact of family-ownership on US firms, while in Barbera and Moores (2013), no productivity gap exists for FFs in Australia.

The ambiguity from productivity studies confirms that the relationship between family involvement and firm performance is complex, nonlinear and multifaceted (Barth *et al.*, 2005; Miller *et al.*, 2007). Importantly, to understand this relationship, it is also necessary to consider that FFs pursue both economic and non-economic goals more than non-FFs (Kim and Gao, 2013; Steier, 2003), and there is no consensus regarding how FFs' peculiarities affect productivity. Indeed, some arguments are in favour of a positive family ownership effect (Anderson and Reeb, 2003; Barbera and Moores, 2013; Miller *et al.*, 2007), but several considerations oppose this conclusion. For instance, some studies have suggested that family members' desire to retain control and ownership can negatively influence firm performance. This argument is supported by agency theory, according to which governance issues might arise in FFs as a result of managerial expropriation and entrenchment by family owners because of their superior position in the firm, thus disrupting its performance (Gómez-Mejía *et al.*, 2001). Moreover, the socio-emotional wealth (SEW) approach advocates that the aspiration of family owners to maintain control might lead to them having fewer top professional managers (Cruz *et al.*, 2010), thereby resulting in less innovation (Cruz and Nordqvist, 2012; Kellermanns *et al.*, 2012) and thus a negative impact on performance. Moreover, ensuring the long-term survival of their businesses may induce FFs to forego investment strategies that could enhance productivity but also yield uncertain returns. Indeed, FFs tend to be characterized by prudence in strategic decision-making due to the close connection between family and firm assets. This risk aversion may prevent them from adopting productivity-enhancing management principles, as they are considered too risky or break with business and family traditions (Cucculelli *et al.*, 2014).

In sum, risk aversion and the desire to retain control might undermine FFs' productivity, leading to this hypothesis:

H1. FFs' ownership has a negative effect on productivity (direct effect)

2.2 Networks moderate the relationship between family ownership and performance

Several papers have demonstrated that both firms' internal capacity and collaboration with other firms affect productivity through several channels, such as new market opportunities, exploitation of scale economies, access to finance and innovation outcomes (Aiello *et al.* 2023a, b; Cisi *et al.*, 2020; Kim *et al.*, 2022; Li *et al.*, 2015).

Regarding external collaboration, its effect on FF performance has been recently investigated by referring to the "open family firm" approach (Lambrechts *et al.*, 2022). Opening up organizational boundaries in collaborating with external actors is a complicated undertaking for FFs and non-FFs alike since it fundamentally alters what organizations are, how they function, how they interact with others and how they maintain value across generations.

Although the theorizing of openness in family enterprises is still in its infancy (Lambrechts *et al.*, 2022), certain studies have examined how trust and contract completeness influence mutual knowledge creation in alliances (Bouncken *et al.*, 2020) and how collaboration and open innovation act as ways to overcome in-house resource constraints or to combine strengths to form new groups (Feranita *et al.*, 2017). This new approach addresses the caveat of prior studies on the family–performance *nexus* because it relaxes the assumption of homogeneity within FFs. Indeed, a deepening of Hypothesis H1 comes from the awareness that differences exist among FFs and their goals (Daspit *et al.*, 2021; Neubaum *et al.*, 2019). As such, various and often conflicting theoretical propositions have been formulated, with empirical research yielding mixed findings, which can be at least partially attributed to FFs' heterogeneity (Daspit *et al.*, 2021; Hernández-Linares *et al.*, 2017).

Another source of firm heterogeneity comes from the "ability–willingness paradox," which here translates into FFs being less willing to engage in collaborations than non-FFs while, at the same time, they possess a higher ability to govern inter-firm partnerships (Guenther *et al.*, 2022).

The ability of FFs to collaborate is related to their long-term orientation and non-financial goals, which lead them to invest in social capital and solid networks beyond the level of non-FFs (Matzler *et al.*, 2015). Social capital refers to the level of trust, reciprocity and closeness of the interaction between the organizational participants (Nahapiet and Ghoshal, 1998), which creates value by improving the knowledge flows between members (Tsai and Ghoshal, 1998). This exists in all organizations, but FFs promote uniquely "strong" social ties (Arregle *et al.*, 2007), gaining more than non-FFs from knowledge flows. This puts them in a better position to exploit knowledge more effectively and improve their performance. Moreover, their generational outlook results in additional reputational resources (Naldi *et al.*, 2008), and the provision of patient capital (Sirmon and Hitt, 2003). These features enable the emergence of long-term trust relationships with external partners and a high level of trustworthiness (Intihar and Pollack, 2012), facilitating a more intense and open knowledge exchange (Mzid *et al.*, 2019). Finally, FFs' peculiarities – i.e. Lack of functional expertise, and low R&D investments – often hamper identification of the resources and capabilities needed for new growth horizons (Aiello *et al.*, 2021; Sirmon and Hitt, 2003). For this reason, they should obtain more significant advantages from collaborating with other firms.

The lower willingness to collaborate is based on FFs' strong concerns about the potential for losing control when collaborating. Indeed, FFs focus on family goals and SEW (Gómez-Mejía *et al.*, 2007; Gómez-Mejía and Herrero, 2022) and are aware that cooperation limits family autonomy regarding decision-making processes. This might decrease their ability to fully exploit the positive effects of collaboration (Zahra, 2012). Because external partnership threatens the SEW of FFs, they have a lower willingness to engage in collaboration with external partners (Nieto *et al.*, 2015). However, the concern to preserve SEW can also contribute to the success of the alliance, although it depends on the ability of FFs to manage the coalition. On balance, it is unclear whether engaging in collaborations helps firms prosper.

The implication is the difficulty to anticipate any apparent effect of collaboration on FFs' performance, given the tension between the need to expand through collaborations to obtain advantages and gain access to resources not otherwise available and the desire to develop a growth approach that is averse to risk and control dilution.

According to the above arguments, we postulate this hypothesis:

H2. The relationship between FFs' ownership and productivity is moderated by networks, and their effect may weaken or strengthen this relationship (moderating effect)

2.3 Moderated–moderating effects of firm age

Prior research analyzing the relationship between age and firm performance suggests that firms do not behave uniformly over their life cycle (Coad, 2018). A related topic refers to age's role in moderating networks' effect on productivity when FFs are considered.

Although firm age has been included in different studies focusing on firm performance (Aiello *et al.*, 2023b; Cucculelli *et al.*, 2014; Stanley *et al.*, 2017; Sciascia and Mazzola, 2008), no scholar has addressed the issue of how age affects the relationship between network, ownership and performance. Thus, an extension of Hypothesis H2 assumes that age moderates the network's impact on the ownership–performance *nexus*. The hypothesis is that FFs' gains from inter-firm cooperation become significant for aged firms. This is grounded on two arguments.

The first refers to firm age as a proxy for experience. The choice of being part of a network requires FFs to change the closed mentality to progressively adopting a business routine based on inter-organizational relationships. This implies the availability of a wide range of skills that FFs only sometimes have when starting a business. Indeed, the FFs differ from other companies in that, in the former, there is generally an overlap of ownership, family and management roles. FFs avoid recruitment from outside the family circle, with the consequence of maintaining direct control over strategic decisions. When family managers are involved in the firm, nepotism and entrenchment of mediocre family executives may limit the availability of human capital to administer complex activities (Block *et al.*, 2023). Consequently, this constraint may translate into a weaker ability to take advantage of collaboration compared to their non-family counterparts. Therefore, FFs usually start with a knowledge deficit because family members need to possess experience in business. Due to the high levels of social capital within FFs (Arregle *et al.*, 2007), they can gain more than non-FFs from knowledge flows (cf. § 2.2). Social capital, thus, constitutes a source of competitive advantage compared to non-FFs (Pearson *et al.*, 2008) and is crucial in enhancing absorptive capacity (Andersén, 2015), which is the critical factor in transforming external knowledge into performance (Gkypali *et al.*, 2018). As these processes take time, the relationship between network and performance is expected to vary with age. The learning process begins after the business is founded and intensifies over time, thereby enhancing the firm's adaptive capacity and strategic flexibility as the external environment changes (Cucculelli *et al.*, 2014). Some studies have revealed how family management improves over time, thanks to new generations of educated family members (Bloom *et al.*, 2008). Non-FFs benefit less from an age-related learning process because they start with competencies and experiences already aligned with the best paradigm for conditions facing the company at the beginning of their tenure (Henderson *et al.*, 2006).

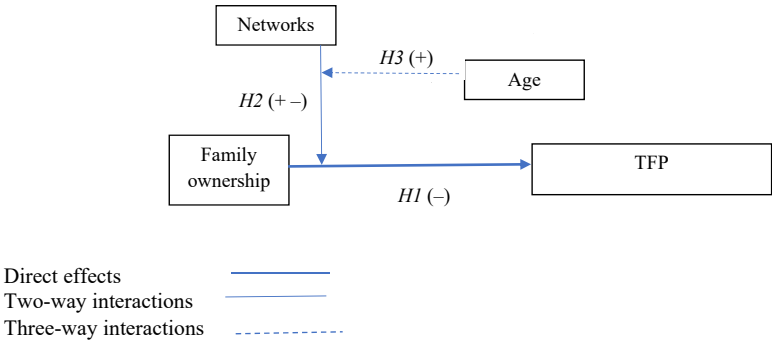
The second argument refers to firm age as a proxy for the generational stage (i.e., Beck *et al.*, 2011; Sánchez-Marín *et al.*, 2020). The participation of family generations in ownership and management is an essential source of heterogeneity and, thus, a crucial factor in understanding FFs' strategic decisions (Gomez-Mejia *et al.*, 2007). From a theoretical point

of view, the SEW perspective suggests that family owners gain from the socio-emotional aspects of the business (Gómez-Mejía *et al.*, 2011). In this context, FFs choose strategies that fulfil their motivations to preserve and enhance the SEW (Liang *et al.*, 2014). In FFs governed by the founder, the SEW orientation is dominant (Le-Breton Miller and Miller, 2013) compared with those governed by subsequent generations. The founders are firmly attached to the business due to their significant involvement with personal investments and informal shared experiences with family members and other stakeholders (Berrone *et al.*, 2012). They know that external cooperation introduces organizational changes and limits family autonomy regarding decision-making. Because founders direct their attention to stability rather than renewal, this can result in superficial learning, which might decrease their ability to fully exploit the positive effects of collaboration (Zahra, 2012). As Sciascia *et al.* (2014) noted, the emotional attachment is likely to decrease in subsequent generations as the succession process dilutes the family members' ownership shares and their affective attachment to and identification with the firm (Gómez-Mejía *et al.*, 2007). Therefore, SEW preservation is expected to be a less relevant goal than economic profitability in subsequent generations. Based on these notions, succeeding generations adopt less conservative decisions and tend to pursue riskier strategies to attain greater financial wealth. Moreover, organizational capabilities expand in terms of variety, making them more adaptable and applicable in different contexts. Consequently, FFs enhance their efficiency in translating collaboration into tangible performance outcomes.

These arguments suggest that age plays a role in understanding whether and how FFs' characteristics affect the relationship between networks and productivity over time. As the age of FFs increases, the preservation of financial wealth more than non-economic goals may positively influence the relationship between collaboration and firm performance. Thus, we formulate the following hypothesis:

H3. The moderating networking effect on the relationship between FFs' ownership and productivity is moderated by firm age (moderated–moderating effect).

In short, hypotheses H1, H2 and H3 led to the following research questions: Does family involvement positively or negatively impact firm productivity? Does inter-firm cooperation affect the productivity gap between FFs and non-FFs? And does age moderate this relationship? Figure 1 illustrates a summary of the conceptual model and the hypotheses.



Source(s): Authors' own creation

Figure 1.
Conceptual framework and hypotheses

3. Empirical setting

The empirical analysis follows a two-step procedure, with the first step involving the estimation of firm TFP [1] In the second step of the analysis, we investigate the relationship between firm ownership and TFP, focusing on the moderating effect of network and the moderated-moderating effect of firm age. The dependent variable is the TFP retrieved from the first step. In contrast, among the independent variables, we consider a variable which identifies whether a firm is in a network (*Network*), a variable for family ownership (*Family*) and firm age (*Age)*.

The *Family* variable is a dummy equal to one if 50% or more of a firm is owned by individuals or families and 0 otherwise. Although there is no universal consensus on how to classify a firm as an FF, most scholars agree that the family must exercise more authority over corporate decision-making than others (Gómez-Mejia *et al.*, 2007) and must subsequently hold a substantial fraction of the company's shares. In this vein, numerous studies have used this criterion to categorize firms into family- and non-family-owned businesses and in many cases the threshold used is over 50% (i.e., Classen *et al.*, 2014; Minichilli *et al.*, 2010; Symeonidou *et al.*, 2021), which assures control of the company.

The variable *Network* is a dummy variable identifying the networking status of the *i*-th firm. It measures the collaboration agreement through which two or more firms exchange information or services, collaborate in specific areas and manage activities to improve performance.

Furthermore, firm age (*Age*) is entered into regressions to verify whether it enhances productivity. It is likely that the experience could foster competence-enhancing activities favoring the implementation of established routines (Acemoglu *et al.*, 2006) or help firms to better recognize and benefit from new technological opportunities (Cohen and Levinthal, 1990), even though it is also possible that age negatively affects firm performance because of inertia (Miller and Shamsie, 2001). Moreover, as regard family ownership, it is plausible that FFs perform better over time than their non-FF counterparts because of their significant knowledge deficit at the time of starting up the businesses and, as a consequence, an age-related learning process is likely to be at work (Cucculelli *et al.*, 2014). Regressions also include some controls, such as the intensity of intangible assets with respect to the number of employees (in log) (*Intangible Assets*) and the variable *Labor unit cost* which is the labor unit cost (in log form)[2]. To control for the size effect, a dummy (*Medium-Large*) is equal to one for firms with more than 50 employees and zero otherwise is included. Sectoral dummies *Ds*, according to the NACE (two-digit) taxonomy, regional dummies *Dr* (NUTS 2 level) and year dummies D_t are also entered in the analysis[3]. While Table A2 in the appendix describes each variable, cites the main related literature and displays the expected effect on productivity, the correlation matrix of the variables is provided as an online Appendix (Table A5 of the online appendix).

Regarding the estimator to be used and considering the interest in assessing the effect of certain variables on TFP, using a log-linear model necessitates exponentiating the predictions in log form. However, this transformation introduces bias into the predictions (see, among many others, Cameron and Trivedi, 2010). Specifically, in a model represented as $y = \exp(x\beta)$, "due to Jensen's inequality, the least squares regression of ln (y) on x is generally an inconsistent estimator for the parameters of $E[y|x] = \exp(x\beta)$" (Santos Silva and Tenreyro, 2022, p. 425). For this reason, we rely on a Poisson model, a suitable alternative to log-linear regression as Santos Silva and Tenreyro (2006) suggested. The drawbacks of employing an estimator for zero-inflated count data models become evident, given its dependence on "very strong assumptions about the distribution of the data" (Santos Silva and Tenreyro, 2022, p. 427). Additionally, addressing overdispersion challenges in models is crucial, as estimates obtained are shown to be "sensitive to the scale of the dependent variable

and to the units in which it is measured, and therefore are arbitrary" (Santos Silva and Tenreyro, 2022, p. 427). Finally, it is worth mentioning that unobservable time-invariant factors which vary among firms may influence TFP. This is the case of the variable of main interest, *Family*, which prevents the use of a fixed effects model.

Given these considerations, in order to estimate the TFP equation, we employ a panel Poisson random model effect using the Stata package. In sum, the analysis is based on the following model:

$$E(TFP\|X) = exp\Big(\beta_0 + \beta_1 Network_{-1} + \beta_2 Family_i + \beta_3 Age + \beta_4 IntagibleAssets_{-1} + \beta_5 LaborUnitCost_{-1} + \beta_6 Medium - Large_i + \sum \delta_s D_s + \sum \varphi_r D_r + \sum \theta_t D_t\Big) \quad (1)$$

We used a panel dataset combining information from two sources. The first source is the Italian Chamber of Commerce, which collects data on the network contracts signed from 2010 until 2018. Besides the firm identifier, the database reports the network name, the partners, the year in which the network was established, the industry code (following the ATECO, 2007 classification) and the province and region in which the firm is headquartered (NUTS 3 and NUTS 2 levels, respectively). The second data source is the Aida dataset (Bureau van Dijk), which contains financial and economic data on Italian firms. Given unreliable or incomplete financial statement entries, we performed a careful data-cleaning procedure. The final sample is a balanced panel with 6,253 firms observed from 2010 to 2018. A detailed description of the sample is reported in the online appendix (Tables A3, A4 and A5).

4. Econometric results

Table 1 displays the estimations obtained from the Poisson random effect model: Panel A refers to the coefficients, while the average marginal effects (AMEs) are in Panel B. Model 1 refers to the baseline equation (1), which is meant to assess the individual impact of ownership, network and age. Model 2 adds the product term Family*Network, while Model 3 considers the interactions Network*Age and Family*Age. Model 4 is a three-way interaction model, including the triple Family*Network*Age. The interaction between Network and Family gauges potential differences in TFP between FFs and non-FFs which are (or are not) in a network. The interaction with *Age* is included to investigate whether the firm age moderates the ownership–TFP nexus. The following sections present the results related to the ownership, network and age effects.

4.1 Ownership effect

This section discusses the results concerning the ownership effect. AMEs show that FFs are less productive than non-FFs: TFP for FFs is lower than that for non-FFs by approximately 4500 euros (Table 1), whatever the model specification. This finding is in line with Hypothesis H1, confirming the negative effect of family-ownership.

However, coefficients and AMEs do not provide answers to many questions of interest. For instance, the negative effect of family involvement might originate from the lack of moderating factors that would be useful to show the underlying mechanisms and boundary conditions relevant to this relationship. To support this claim, we now focus on *Network* and *Age*, considered important sources of FF heterogeneity (Guenther *et al.*, 2022; Block *et al.*, 2023).

4.2 Network effect

From Tables 1, it emerges that, on average, *Network* does not significantly influence firm TFP [4]. The AMEs are positive but not significant, thereby partially confirming the business

	Model 1	Model 2	Model 3	Model 4
Panel A: Estimated Coefficients				
Family	−0.101***	−0.101***	−0.101***	−0.128***
	(0.0084)	(0.0084)	(0.0084)	(0.0202)
Network	0.0144	0.0258	−0.0378	0.0302
	(0.0127)	(0.0176)	(0.0322)	(0.0418)
Age	−0.00119***	−0.00119***	−0.00122***	−0.00164***
	(0.0003)	(0.0003)	(0.0003)	(0.0004)
Intangible Assets	−0.000150	−0.000153	−0.000125	−0.000126
	(0.0013)	(0.0013)	(0.0013)	(0.0013)
Labor Unit Cost	0.323***	0.323***	0.323***	0.322***
	(0.0182)	(0.0182)	(0.0182)	(0.0182)
Medium-Large	−0.0587***	−0.0587***	−0.0588***	−0.0593***
	(0.0088)	(0.0088)	(0.0088)	(0.0088)
Family*Network		−0.0227		−0.150**
		(0.0251)		(0.0619)
Network*Age			0.00162*	−0.0000817
			(0.0009)	(0.0011)
Family*Age				0.000847
				(0.0006)
Family*Age*Network				0.00382**
				(0.0017)
Constant	0.344*	0.344*	0.346*	0.360*
	(0.1993)	(0.1993)	(0.1993)	(0.1989)
Ln(α)	−2.540***	−2.540***	−2.540***	−2.541***
	(0.1806)	(0.1807)	(0.1806)	(0.1806)
Observations	50024	50024	50024	50024
Chi-squared	4017221.9	4016746.1	4018480.3	4045570.0
p-value for model test	0	0	0	0
Panel B: Average Marginal Effects				
Family	−4.513***	−4.513***	−4.512***	−4.532***
	(0.3799)	(0.3799)	(0.3800)	(0.3792)
Network	0.644	0.630	0.583	0.646
	(0.5692)	(0.5692)	(0.5674)	(0.5605)
Age	−0.0529***	−0.0530***	−0.0524***	−0.0514***
	(0.0118)	(0.0118)	(0.0118)	(0.0117)
Intangible Assets	−0.00666	−0.00677	−0.00556	−0.00560
	(0.0591)	(0.0591)	(0.0591)	(0.0591)
Labor Unit Cost	14.31***	14.31***	14.31***	14.30***
	(0.7892)	(0.7894)	(0.7894)	(0.7879)
Medium-Large	−2.618***	−2.617***	−2.622***	−2.643***
	(0.3961)	(0.3962)	(0.3963)	(0.3960)

Note(s): Robust standard errors (clustered at firm level) in parentheses. Year, industry (NACE two-digit) and regional (NUTS 2) fixed effects included. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Source(s): Authors' own creation

Table 1.
Firm TFP and the role of ownership, network and age. Estimations from a Poisson random effect model

network effect found by prior literature (Burlina, 2020; Cisi *et al.*, 2020; Fabrizi *et al.*, 2020)[5]. However, looking at the individual average effect – without considering the potential channels through which firm ownership and external collaboration interact – does not allow a detailed understanding of the phenomena under scrutiny. The interaction term Family*Network (Model 2) helps to evaluate whether and to what extent the impact of the Network on TFP differs between FFs and non-FFs and whether the results are stable within the two groups of firms (FFs and non-FFs).

In interpreting the product term, we convey the results in Figure 2, in which the predicted TFP is plotted against the *Network*, distinguishing between FFs and non-FFs.

Differently from what would emerge from the AMEs, Figure 2 adds new arguments. First, being part of a Network enhances the TFP, regardless of firm ownership. Furthermore, the Network benefits are high for non-FFs and negligible for FFs. Indeed, for non-FFs, the TFP increases from 46.78 when firms do not collaborate to 48.04 when they are in a network, while for FFs the increase of TFP is low (from 42.3 to 42.46). Finally, non-FFs perform better than FFs, independently of whether or not they signed a network contract, thereby additionally supporting Hypothesis H1.

These results are still unsatisfactory. Based on the fact that differences in means are not significant, one could conclude that network contracts do not play a role in explaining TFP. However, being part of a network might act as a moderator (Hypothesis H2) in different ways at different stages of the firm life cycle (cf. §2.3). To this aim, the following section focuses on the moderating effect of firm age.

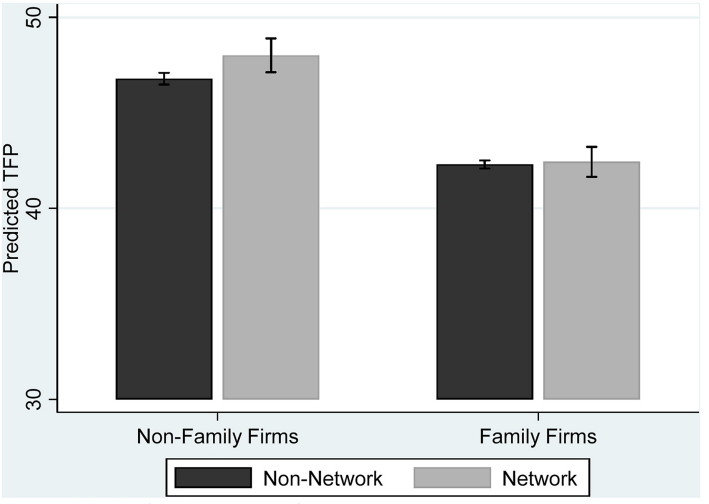
4.3 Age effect

To better explain the unclear effect of being part of a network, we consider the estimations of Model 3 in Table 1 (Panel A), which includes the term Network*Age [6]. This allows the network effect to be assessed at different values of firm age, thereby testing Hypothesis 3.

One might be interested in the moderating role of aging, independently of firm ownership: from Figure 3 emerges that the network effect increases with age, highlighting that age matters.

In line with the main scope of the paper, we proceed by detecting whether the variable *Network* moderates the ownership–TFP *nexus* differently at different stages of firm age. To this end, we use the Model 4 of Table 1. In this respect, Figure 4 plots the AME associated with ownership at different values of age, distinguishing between firms that have not signed (Panel A) or signed (Panel B) a network contract. Panel C visualizes the contrast effect.

Without collaborations (Panel A), the line of ownership effect is below the *X*-axis, indicating that FFs always perform less well than non-FFs. However, the ownership effect



Source(s): Authors' own creation

Figure 2.
Predicted TFP across *Network*, for FFs and non-FFs

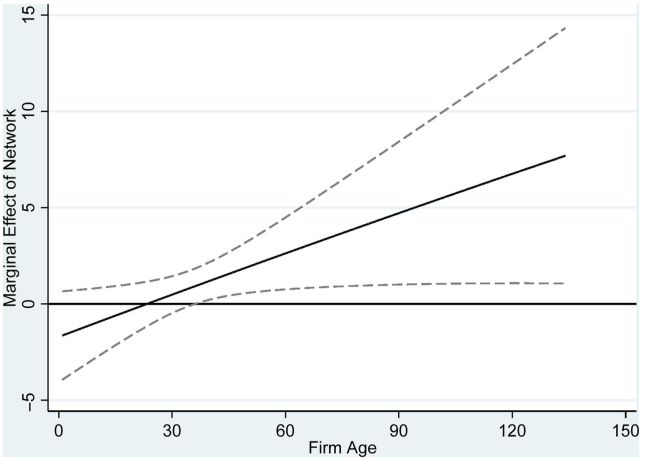


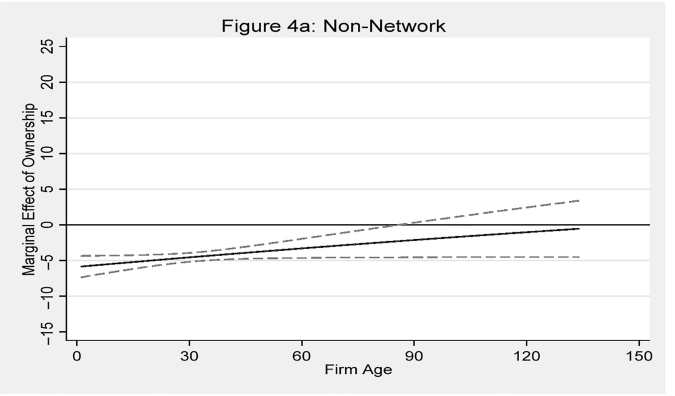
Figure 3.
Marginal effects of *Network* on TFP across age

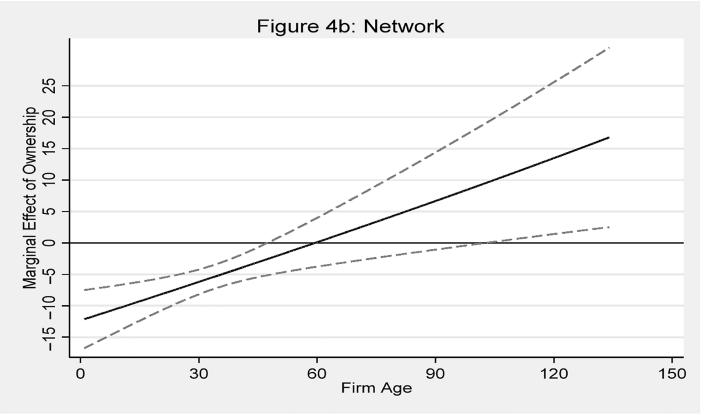
Source(s): Authors' own creation

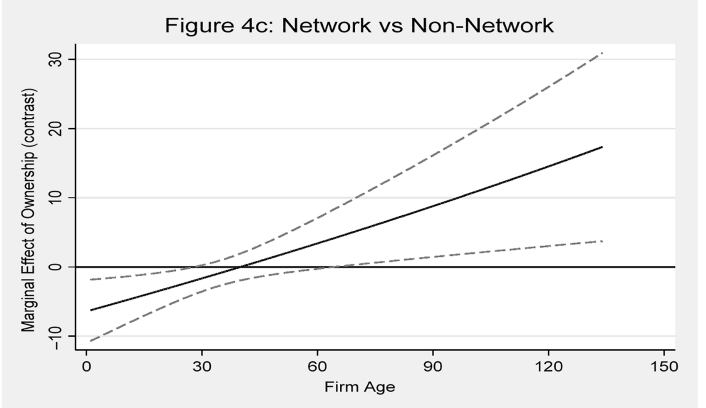
tends to zero, signaling that the gap decreases as age increases, with differences that are statistically significant up to 86 years. The evidence changes when firms are in a network (Panel B). It is confirmed that age still matters in moderating the ownership–TFP nexus, but diverging effects appear: a TFP gap remains for young FFs, but middle-aged FFs perform better than non-FF peers. To summarize the results, Panel C of Figure 4 plots the contrast of marginal effects, which use the difference between FFs and non-FFs when they are or are not in a network at different ages, that is $[(\text{FF} - \text{non-FF})_{\text{Network}} - (\text{FF} - \text{non-FF})_{\text{NoNetwork}}]$. The synthesis is as follows. As age increases, the effect of signing a network contract translates into reducing the TFP gap of FFs. Furthermore, important patterns emerge because the final effect is negative and positive, depending on firm age. When firms are young (up to 24 years), being in a network exerts a positive effect with age but not enough to balance the negative ownership effect. There is a range between 25 and 88 years with no difference in results. Interestingly, FFs in a network significantly outperform non-FFs as they become old.

Finally, Figure 5 plots the TFP against age, distinguishing firms by ownership and network membership. Panel A focuses on firms that do not collaborate with others. In such cases, TFP decreases with age for both groups of firms, although the TFP line of FFs lies below that of non-FFs. Moreover, as TFP declines at different rates faster for non-FFs than FFs), the gap disappears for the oldest firms. On the contrary, being in a network (Panel B) introduces different patterns. TFP decreases with age for non-FFs and, interestingly, increases for FFs. Furthermore, differences in TFP are significant when firms are young (up to 46 years) or old (> 100 years). Therefore, we find that young FFs that are part of a network perform less well than their non-FF counterparts, while old FFs gain much from collaborating. TFP differences become increasingly large as firm age rises.

These results seem to be driven by an inertia effect (Hannan and Freeman, 1984), whereby older firms are unable to adjust their structure and strategies in a dynamic environment and are not flexible in adopting technologies (Harris and Moffat, 2015; Powers, 1998). Moreover, age negatively affects the firm's productivity because of the diminishing returns of learning for firm dynamics (Jovanovic, 1982). Interesting arguments emerge when FFs are the focus. An explanation can be given by referring to the "learning-by-doing effect" and the "inertia effect," which act positively and negatively on TFP. In aged FFs, the inertia effects prevail for those who do not join a network, while the learning-by-doing effects become dominant for cooperative firms. Hence, the benefits of entering a network are substantial for FFs.







Source(s): Authors' own creation

Figure 4.
Ownership marginal effects across age, for firms in Networks and firms not in Networks

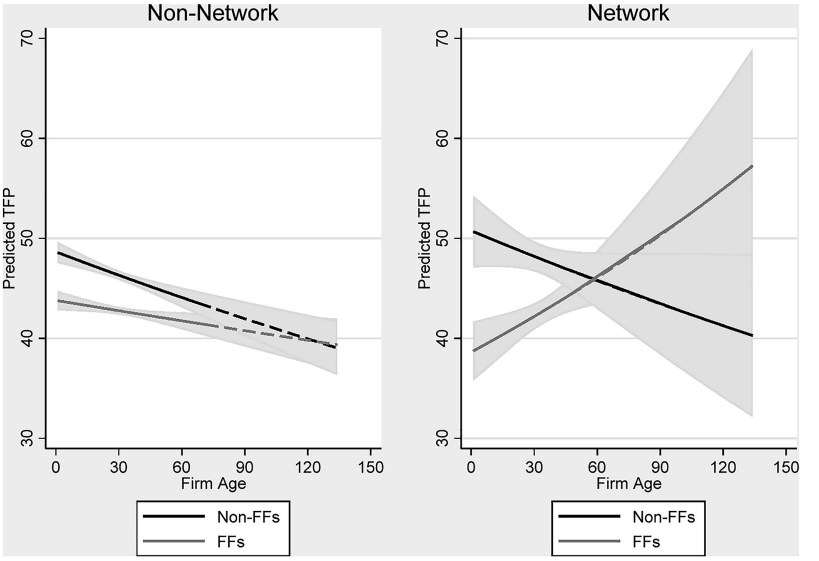


Figure 5.
Predicted TFP across age, for firms not in Network and in Network

Source(s): Authors' own creation

All the above considerations support Hypothesis H3, according to which the effect of inter-organizational cooperation differs according to age [7].

5. Discussion and conclusion

Despite scholarly attention to FFs' performance, the results are still unclear because the sources of firm heterogeneity have not been adequately considered. This study contributes to this field of research in two ways. First, when detecting differences between FFs and non-FFs, cooperation is hypothesized to affect the relationship between family ownership and TFP. Second, age is supposed to act as a moderated–moderating variable. The ownership–performance nexus is investigated using a sample of 6,253 Italian manufacturing firms over the period 2010–2018. Results are threefold.

First, FFs are, on average, less productive than non-FFs: AMEs of FFs are always negative. Here, the paper provides new evidence for the unfolding debate between scholars who suggest a positive effect of family involvement on productivity and those who reach the opposite conclusions (cf. § 2.1). Thus, this work complements the existing research and confirms that some characteristics of FFs, such as their non-optimal use of human and financial resources and their risk aversion, probably lead to weaker performance when compared with that of their non-family peers.

Second, we find a positive average effect of being part of a network, although it is not significant. The case of the Italian Network Contract has been analyzed by several scholars (Burlina, 2020; Cisi *et al.*, 2020; Corazza *et al.*, 2022; Fabrizi *et al.*, 2020; Leoncini *et al.*, 2020), who, however, do not distinguish between FFs and their non-FF counterparts and use measures of firm performance other than TFP. There are at least two advantages of referring to TFP. On the one hand, TFP is an indicator of overall performance. It provides an insight into efficiency growth through intangible factors such as technological change, research and development and human capital accumulation, which are the most relevant factors for firm growth opportunities. Conversely, TFP is a reliable measure of performance because, compared to other financial measures, it is not subject to earnings manipulation.

Positioning our research in the family business literature, the results partially contrast with the prior scant evidence according to which FFs gain from external collaboration (e.g., Aiello *et al.*, 2021; Muñoz-Bullón *et al.*, 2020). Here, it is worth mentioning that the firms can design quite different forms of collaboration with various degrees of formalization. This paper focuses on inter-firm networks characterized by a formal structure within a well-defined regulatory context, in which firms formalize collaboration to innovate and improve productivity. The soundness of this collaboration is based on frequent, repeated and enduring interactions. Therefore, they differ from other types of collaborations, where firms have informal relationships with each other. Importantly, we also hypothesize that the network membership effect on TFP is related to learning processes and to varying firm objectives over the business life cycle. In other words, it is assumed that age moderates the impact of inter-firm cooperation on the ownership-TFP relationship.

This leads to the third and main finding, which arises from combining ownership, network and age effects. The aim is to enrich the evidence on the role of external collaboration and firm age as contingent factors in FFs' heterogeneity. In more detail, we provide empirical support for the argument that inter-organizational cooperation and firm age mitigate the negative relationship between ownership and TFP, thereby identifying the conditions that would translate family involvement into higher TFP. It is found that a network contract acts as a moderator in different ways according to FFs' age: young FFs underperform compared to their non-FF peers, although the TFP gap decreases with age; oppositely, middle-aged FFs outperform their counterparts, and their TFP gain increases with age.

From the above, we learn that, for FFs, age matters in exploiting the benefits of entering a network. There are two explanations for this. On the one hand, FFs seem to be better able to benefit from an age-related learning process because of their uniquely "strong" social ties (Arregle *et al.*, 2007). On the other hand, the SEW factors (Gómez-Mejía *et al.*, 2011; Le-Breton Miller and Miller, 2013) decrease over time (Sciascia *et al.*, 2014), making economic profitability a more relevant goal than SEW preservation.

Finally, the research reveals practical implications for FF owners and policymaking.

Regarding the practical implications, the study provides evidence that FFs can outperform non-FFs when they move away from SEW-centered reference points and exploit knowledge flows arising from high levels of social capital. In the case of mature FFs, networking is a driver of TFP, allowing them to acquire external resources. Since FFs often do not have sufficient in-house knowledge and resources, it is vital that they are aware of the value of business cooperation. While preserving the familiar identity of small companies, networks grant FFs the competitive and scale advantages of being large. This aspect is fundamental, especially considering that firms are increasingly operating in turbulent environments in which rapid access to knowledge and resources has become crucial to remain competitive. Subsequently, this study may help FFs recognize and address specific constraints and opportunities in developing cooperation-based competitive advantages. In particular, to exploit the advantages of collaboration, the FF, at least in the initial stages, should increase the heterogeneity of the top management team by hiring non-family managers, encouraging family members to work for other firms, and using external boards. Emphasis on the well-being of family members to the detriment of their productivity may lead to the demise of FFs. At the same time, an effective balance between the benefits of the informal system and the effective management of resources is necessary.

Several policy implications come from the results of this study. Small and medium-sized enterprises are widely acknowledged for their fundamental role in the economies of many countries. Despite their inherent flexibility, these enterprises face limitations due to their size, hindering their ability to handle competitive pressures. Along this line of reasoning, our analysis emphasizes the effectiveness of networks in opening business opportunities.

Additionally, recognizing the considerable heterogeneity of effects identified in this study represents an opportunity to enhance policy outcomes further. Indeed, the lesson from our evidence is that there are between- and within-group differences: FFs differ from non-FFs and among themselves. FFs' behavior is not homogeneous over the cycle life, and the effect of external collaborations diverges from age to age. This suggests that policymakers should design targeted incentives because one-size-fits-all policies supporting firm collaboration are not likely to be effective. Policies should be designed by considering firms' life courses and ownership structure. In conclusion, despite the wide but ambiguous body of research on the performance gap between FFs and non-FFs, little is known about the role of FFs' heterogeneity. This study has proven successful in detecting age as a factor in heterogeneity, specifically to explain the network effect on the link between ownership and TFP. Based on a representative sample, the study provides a solid framework for the FFs decision-making process, policymakers and academic research on FFs.

Notes

1. For the estimation of the TFP and results see the online Appendix (Section A1, Table A1).
2. The intangible fixed assets have been deflated by using the GDP price indices released by Eurostat, while for the labor costs we used the consumer price index for blue-collar and white-collar families (data are from ISTAT).
3. Regressors are one-year lagged to mitigate the potential endogeneity bias.
4. A potential endogeneity of the Network due to reverse causality could occur. In order to test whether there is an endogeneity issue, we have considered the "Rule of Law" of the Institutional Quality Variable (Nifo and Vecchione, 2014) as an instrumental variable since operating in regions with strong rule of law contributes to assuring certainty and enforceability of the inter-firm cooperation. After performing appropriate tests, we conclude that the results are free of endogeneity bias.
5. Although these scholars measure firm performance using indicators other than TFP, Cisi *et al.* (2020) discovered that *networks* have a positive effect on some company performance indicators, such as a firm's gross margin ratio and exports, but not on profits. Similar evidence is found when considering turnover growth (Burlina, 2020) or employment (Fabrizi *et al.*, 2020).
6. Although the focus of the paragraph is on the moderating effect of Age, here it is worth highlighting that Age has a negative and significant average effect on firm TFP: AME is about −0.05 (Table 1), suggesting that younger firms benefit in terms of productivity.
7. Results from robustness checks are in the online appendix (Section A3, Table A6 and Figure A1).

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Online Appendix

The supplementary material for this article can be found online.

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